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The Effects of Teaching a Summary Skills Strategy to Students Identified as Learning Disabled on Their Comprehension of Science Text

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THE EFFECTS OF TEACHING A SUMMARY SKILLS STRATEGY TO STUDENTS IDENTIFIED AS LEARNING DISABLED ON THEIR COMPREHENSION OF SCIENCE TEXT

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ABSTRACT

The effects of a summary skills learning strategy on the comprehension of science text were examined with 5 elementary-age urban minority special education students in a summer remedial program. The program's effect on the overall completeness of the students' written summaries and the maintenance of the strategy also were examined. Following baseline, the summary skills strategy was introduced in both group and individual reading settings according to a multiple baseline across settings design. Student performance was assessed in both setting, and maintenance was probed at 4 weeks in the individual reading setting. The strategy produced clear improvement in the comprehension of science text, which was associated with similar improvements in the completeness of the written summaries. The students reported that the summary skills strategy was effective for helping them understand science text. Furthermore, a group of 15 general education elementary school teachers thought that the strategy was effective and that it would be easy to implement.

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Students identified as learning disabled and others experiencing difficulty in school are often characterized by a lack of active task engagement and persistence (Graham & Harris, 1989; Torgesen, 1982) and by the lack of skills necessary to execute and monitor the cognitive processes central to academic success (Alley & Deshler, 1979; Baumann, 1984). Because of these generalized deficits in cognitive performance, learning strategy instruction appears to be especially beneficial for such students. A prolific body of work on learning strategy instruction has shown that students identified as learning disabled and others experiencing difficulty in school can be taught task-specific learning

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strategies in areas such as writing (Englert, Raphael, Anderson, Anthony, & Stevens, 1991), mathematics (Mastropieri, Scruggs, & Shiah, 1991), academic task completion (Smith, Young, Nelson, & West, 1992), test-taking skills (Hughes & Schumaker, 1991), memory (Pressley & Dennis-Rounds, 1980), and reading (Borkowski, Weyhing, & Carr, 1988).

These strategies would appear to be especially useful in the area of reading because many students identified as learning disabled have been found to be less able to identify main ideas (Wong, 1979), have more difficulty in summarizing text (Winograd, 1984), and have more difficulty monitoring their learning (Pressley, Johnson, & Symons, 1987) than normally achieving students. Research on learning strategy instruction in reading has focused on self-questioning (Clark, Deshler, Schumaker, Alley, & Warner, 1984; Wong, Wong, Perry, & Sawatsky, 1986), paraphrasing (Hansen, 1978; Schumaker, Denton, & Deshler, 1984), visual imagery (Clark et al., 1984), and summary skills instruction (Brown & Day, 1983; Day, 1980). Training programs in these areas are based on the use of a cognitive task analysis that identifies the processes engaged in by successful readers. Furthermore, a typical training sequence proceeds from modeling the teacher's instructions, to overt rehearsal, and finally to covert rehearsal. This instructional sequence is designed to help the learner acquire the skills necessary to guide and control performance on the target reading task.

Summary skills strategies were developed because the summarization of text is particularly useful for those readers who cannot spontaneously use comprehension strategies (Dee-Lucas & DiVesta, 1980; Hidi & Anderson, 1986). The general rules of summarization include (a) deletion of unnecessary information, (b) substitution of a superordinate term for a list of items or actions, and (c) selection of a topic sentence (Brown & Day, 1983). These rules of summarization help students to retain important information from text (Kintsch & van Dijik, 1978). In addition to improvements in summary skills, this research has shown that summarization instruction may improve reading comprehension. Hare and Borchardt (1984), for example, taught intermediate and high school students five summarization rules: collapse lists, use topic sentences, remove unnecessary detail, collapse paragraphs, and polish the summary. The students were then provided a guide to help them direct their use of the summarization rules. This resulted in significant improvements in the quality of the students' summaries, which was associated with an increase in their comprehension of literature. A 2-week follow-up probe indicated that these results maintained.

Students with learning disabilities and poor readers have been taught to summarize expository reading passages (Armbruster, Anderson, & Ostertag, 1987; Bean & Steenwyk, 1984; Brown & Day, 1983; Day, 1980; Garjria & Salvia, 1992; Hare & Borchardt, 1984; Palincsar & Brown, 1984; Rinehart, Stahl, & Erickson, 1986; Taylor, 1982; Taylor & Beach, 1984; Winograd, 1984). This work, however, has been conducted exclusively with expository

passages that were developed or modified to meet the task demands associated with summarization strategies. In other words, each passage typically contained one major point that could be indicated in a topic sentence, unnecessary information that had to be deleted, and a list of items or actions that had to be incorporated into a superordinate term. There appears, however, to be no research conducted to date on the effects of summary skills strategies using content area textbooks or expository literature that have not been structured to meet the task demands of these strategies. This information is important because the task demands associated with the summarization of content area texts, for example, vary across assigned reading. Therefore, the purpose of this study was to assess the effects of the instruction in a summarization strategy on the comprehension of science text. The generalization and maintenance of the treatment effects were also studied.

Method

Students and Setting

Five (4 males and 1 female) culturally diverse students with learning disabilities from a large midwestern school district participated in this study. These students were classified as learning disabled based on the state rules and regulations. They received special education services in resource room settings for approximately 50% (range = 33% to 66%) of the school day. They were selected for this project based on the special education teacher's recommendation and poor reading comprehension scores on the Iowa Test of Basic Skills (ITBS). Table 1 presents the ethnicity, age, grade level, and ITBS percentile reading comprehension score for each student.

This study was conducted at a university-affiliated remedial education clinic. The clinic teacher conducted the group and independent experimental sessions

Table 1
Student Characteristics

Student	Ethnicity	Age	Grade[a]	ITBS[b]
Jamel	African–American	10.4	4	16
Tyrone	African–American	9.5	4	23
Kashana	African–American	11.3	6	31
Enrique	Mexican–American	11.4	6	19
John	Anglo–American	13.7	8	27

[a]Grade the student will enter in the fall.
[b]Iowa Test of Basic Skills percentile comprehension score.

during two 45-minute instructional periods. The classroom was approximately 10 × 15 meters and had three tables and accompanying chairs at which the participating students sat during the experimental sessions. The room was equipped with a one-way mirror for observation. No other students were in the room during any of the experimental sessions.

Dependent Measures and Reliability Assessment

Two areas of academic performance were assessed: (a) completeness of the students' text summaries and (b) reading comprehension. In addition, the fidelity of implementation and the social validity of the summary skills strategy were measured.

Completeness of the Text Summaries. The overall completeness of the text summaries, relative to the content of the passage read, was determined by computing the percentage of important information included in each of the summaries. Prior to scoring the summaries, the clinic teacher and experimenter determined through discussion between themselves the important information that should be contained in a complete summary. Two scorers independently counted the number of important information items as "included" or "not included" by following the predetermined key for each passage. To determine the percentage of important information items included in the summaries, the number of items included were summed and divided by the total possible number of important information items and multiplied by 100. Reliability was assessed by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The average agreement across all students and conditions was 96% and ranged from 87% to 100%.

Reading Comprehension. Student comprehension of each passage was assessed with 10-item multiple choice tests developed by the clinic teacher. Two scorers independently scored the items as correct or incorrect by following an answer key that was also developed by the clinic teacher. To determine the percentage correct, the items scored as correct were summed and divided by the total number of items and multiplied by 100. Reliability was assessed by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Percentage of agreement across all students and conditions was 100%.

Fidelity of Implementation. Fidelity of implementation of the summary skills strategy was assessed under both group and independent reading conditions (described below). Fidelity of implementation under the group reading condition was assessed by observing the teacher on each day of instruction. The primary researcher used a checklist to indicate whether the teacher completed each instructional function in sequence. The teacher and primary investigator met to discuss and adjust any instructional changes that occurred, as necessary. Fidelity of implementation was also assessed by scoring the steps on the students'

self-directed guides as complete or incomplete. To determine the percentage complete, the total number of steps complete was divided by the total number of possible steps and multiplied by 100.

For the independent reading condition, fidelity of implementation was assessed by scoring every step on the students' summary skills guides as complete or incomplete. The procedures described above to determine the percentage complete were used to compute the percentage of steps complete under the independent reading condition.

Social Validity. The social validity of the summary skills learning strategy was assessed by interviewing the participating students and surveying a group of general education teachers. Students were individually asked four questions regarding the effectiveness and usefulness of the summary skills strategy. (The questions are presented in Table 2.) Students indicated their response to each question by pointing to the response on a 5-point scale (*No, no, ?, yes, Yes*). A complete explanation of the scale was provided to the students prior to their answering the questions.

Fifteen general education elementary school teachers enrolled in summer courses in education independently observed one class period (group and individual experimental sessions) through a one-way mirror. They were then asked to independently complete a five-question survey regarding the effectiveness and ease of implementation of the summary skills strategy. (These questions are also presented in Table 2.) Teachers indicated their response on a 5-point scale (1 = *strongly agree* to 5 = *strongly disagree,* 3 = *undecided*).

Design, Summary Skills Strategy, and Experimental Conditions

Design. Students were observed under baseline, summary strategy, and follow-up conditions (independent reading condition only). All training occurred in a group setting, and maintenance and generalization were assessed in an individual setting. Initially, the teacher directed a group science reading and writing activity. Students then worked independently on a related reading and writing assignment. It is important to note that, following the guidelines provided by Walker (1988), informal inventory reading assessments were conducted to ensure that each student's related independent reading assignments were at their independent reading level (i.e., the students were capable of independently reading at least 85% of the words correctly). A multiple baseline across settings (group reading, independent reading, and follow-up) design (Hersen & Barlow, 1976) was used to examine the effects of the summary strategy on the overall completeness of the summaries and reading comprehension of the students. This design was also used to assess the generalization and maintenance of the treatment effects.

Summary Skills Strategy. To develop the summary skills strategy, the clinic teacher and researchers discussed the general rationale for learning

strategy instruction and for the summary skills strategy. This included a review of the summary skills strategies developed by Hare and Borchardt (1984) and the theoretical work of Kintsch and van Dijik (1978). The clinic teacher and researchers then followed the self-instructional strategy training procedures provided by Graham and Harris (1989) to develop the summary skills strategy specifically for the science text. After analyzing the organizational structure of the science text, they conducted a task analysis of the behaviors required to complete a summary of the text. This was done in accordance with the knowledge base of the teacher regarding the students' learner characteristics (e.g., cognitive capacity and capabilities). It is important to note that the students were enrolled year round in the remedial clinic. Following the task analysis, the individual strategy components and associated steps were developed. The principal behaviors were then sequenced. This resulted in a two-component, nine-step summary skills strategy:

A. Identify and Organize the Main Idea and Important Information
   1. What was the main idea? Write it down.
   2. What important things did the writer say about this? Write them down.
   3. Check to make sure you understood what the main idea was and the important things the writer said about this.
   4. What is the main idea or topic that I am going to write about? Write it down.
   5. How should I group my ideas? Put a 1 next to the idea you want to be first, put a 2 next to the idea you want to be second, and so on.
   6. Is there any important information that I left out and is there any unimportant information that I can take out?
   7. Write the summary.

B. Clarify and Revise the Summary.
   8. Reread your summary. Is there anything that is not clear? Revise your summary if necessary.
   9. Ask your classmate to read your summary and tell you if there is anything that is not clear. Revise your summary if necessary.

A summary skills guide was then developed that included these steps (see Figure 1). The guide was used during group and independent reading conditions both for instruction and to facilitate students' use of the strategy, independent of the teacher.

Baseline. Under baseline conditions no experimental procedures were in effect. In the group reading setting, the teacher read a passage (typically four paragraphs) from a science text, *Dinosaurs* by John Mann (1988), while students followed along in their texts. The students then wrote a summary on what had been read and completed a comprehension test on the passage. In the in-

Summary Writing Guide

Identify and Organize the Main Idea and Important Information

Step 1

Think to yourself—"What was the main idea?"
Write it down._____

_____

Step 2

Think to yourself—"What important things did the writer say about the main idea?"
Write down the important things that the writer said.
1._____
2._____
3._____
4._____
5._____

Step 3

Go back and check to make sure you understood what the main idea was and the important things the writer said about this.

Step 4

Think to yourself—"What is the main idea or topic that I am going to write about?"
Write a topic sentence for your summary._____

_____

_____

Step 5

Think to yourself—"How should I group my ideas?" Put a 1 next to the idea you want to be first, put a 2 next to the idea you want to be second, and so on.

Step 6

Think to yourself—"(1) Is there any important information that I left out or (2) is there any unimportant information that I can take out?"

Step 7

Write a summary about what you read.

Step 8

Read your summary and think to yourself—"Is there anything that is not clear?"
Rewrite your summary (if necessary).

Clarifying and Revising the Summary

Step 9

Ask your classmate to read your summary and ask him to tell you if there is anything that is not clear.
Rewrite your summary (if necessary).

Figure 1. Summary skills guide used by students under the group and independent reading conditions. The guide has been condensed. The original summary guide provided space for the students to fully complete the summary.

dependent reading setting, students independently read a related passage and wrote a summary of this passage. Students then completed a comprehension test on the passage. In both settings, the teacher provided assistance on word recognition but gave no further help to the students.

Group Reading Setting. Summary skills training included an introductory session followed by the instructional sessions. The introductory session objectives were that students understood the general components and the associated steps of the summary skills strategy and were aware of how the components and steps worked. The teacher provided a general introduction to the purpose of the strategy and its importance in helping them to better understand the information in their science texts. This included a description of a summary: "A summary should contain only important information; personal and unnecessary information is left out. Information is combined when possible. Information is added to make the summary more understandable and it is written in your own words." The introduction also included a description of the cues that help identify the main idea(s): "Look for large type size, italics, and words that are underlined; words and phrases like 'important,' 'relevant,' and 'the purpose is; pictures, tables, and other things accompanying the text; and introductory or summary sentences and repetition of words and sentences." Third, the teacher described the steps in the strategy and reasons for each step. Students then listened and followed along as the teacher read a passage and modeled how to use the summary skills guide. (Two overhead projectors were used to display the passage and the summary skills guide.) Immediately following the discussion, each student was asked to verbally describe and practice (a) the summary skills strategy, (b) the cues that help identify the main idea(s) of a passage, and (c) the steps in writing a summary of science text and the manner in which each step helped them to do this. All students described a summary and the cues that help identify the main idea(s) of a passage, restated the steps, and explained the importance of each.

In the instructional sessions, the teacher followed a three-part teaching script: review, modeling, and guided practice. Each step of the strategy was reviewed. (Two overhead projectors were used to display the passage and the summary skills guide.) Next, students listened and followed along with the teacher as she modeled the use of the strategy while "thinking out loud." To actively engage the students, the teacher used self-instruction statements throughout, such as "What is it I have to do? I need to . . . ." The students were encouraged to help the teacher. After modeling, the teacher and students discussed the importance of "thinking to themselves" while reading and completing a summary of a science text. Students practiced the strategy using the summary skills strategy guide to write a summary of the passage with guidance from the teacher. The students then completed a short comprehension test. Because it was clear that the students understood the summary skills strategy (as evidenced by their 100% completion of four consecutive summary guides) and to alleviate poten-

tial student dissatisfaction, the explanation and modeling parts of the training were discontinued after the fifth instructional sesssion. Thus, in all subsequent group reading sessions, the students listened and followed along using their own summary guides as the teacher read a passage. The students then practiced the strategy using the summary skills strategy guide to write a summary of the passage, and the teacher provided guidance if necessary. Finally, students completed a short comprehension test. The duration of the group reading sessions (range = 16 to 43 minutes) consistently decreased across the training sessions as the students became more fluent in the use of the summary skills strategy. For example, the duration of the final instructional session was approximately 16 minutes, whereas the duration of the intitial session was 43 minutes.

Independent Reading Setting. During the independent reading sessions, students independently read and used the summary skills strategy guide to write a summary of a related science passage on dinosaurs (typically three to four paragraphs). The students then completed a comprehension test. The teacher provided assistance with spelling but gave no other help to students. As with the group reading sessions, the duration of the independent reading sessions consistently decreased (range = 15 to 33 minutes) across the training sessions.

Follow-Up. Four weeks after the last experimental session, students were asked to describe the steps they would use to find the important information in a science passage and write a summary of a passage. All of the students verbally stated, in sequence, the nine steps included in the summary skills strategy. The students were then asked to independently read and write a summary of a science passage. (The students did not use the summary skills guide.) They then completed a comprehension test on the passage.

Results

Figure 2 presents the percentage of important information included in the summaries and the percentage of items scored correct on the comprehension tests. Inspection of Figure 2 shows that clear increases in the percentage of important information included in the summaries (relative to the content of the passage read) occurred when the summary skills strategy was introduced. In each session, the procedure resulted in consistently high levels of performance for all of the students. These higher levels of performance were consistent across the group and independent reading settings, and were maintained at follow-up in the latter setting.

Paralleling the improvements in the percentage of important information included in the summaries, the reading comprehension of each student increased substantially in all sessions when the summary skills strategy was

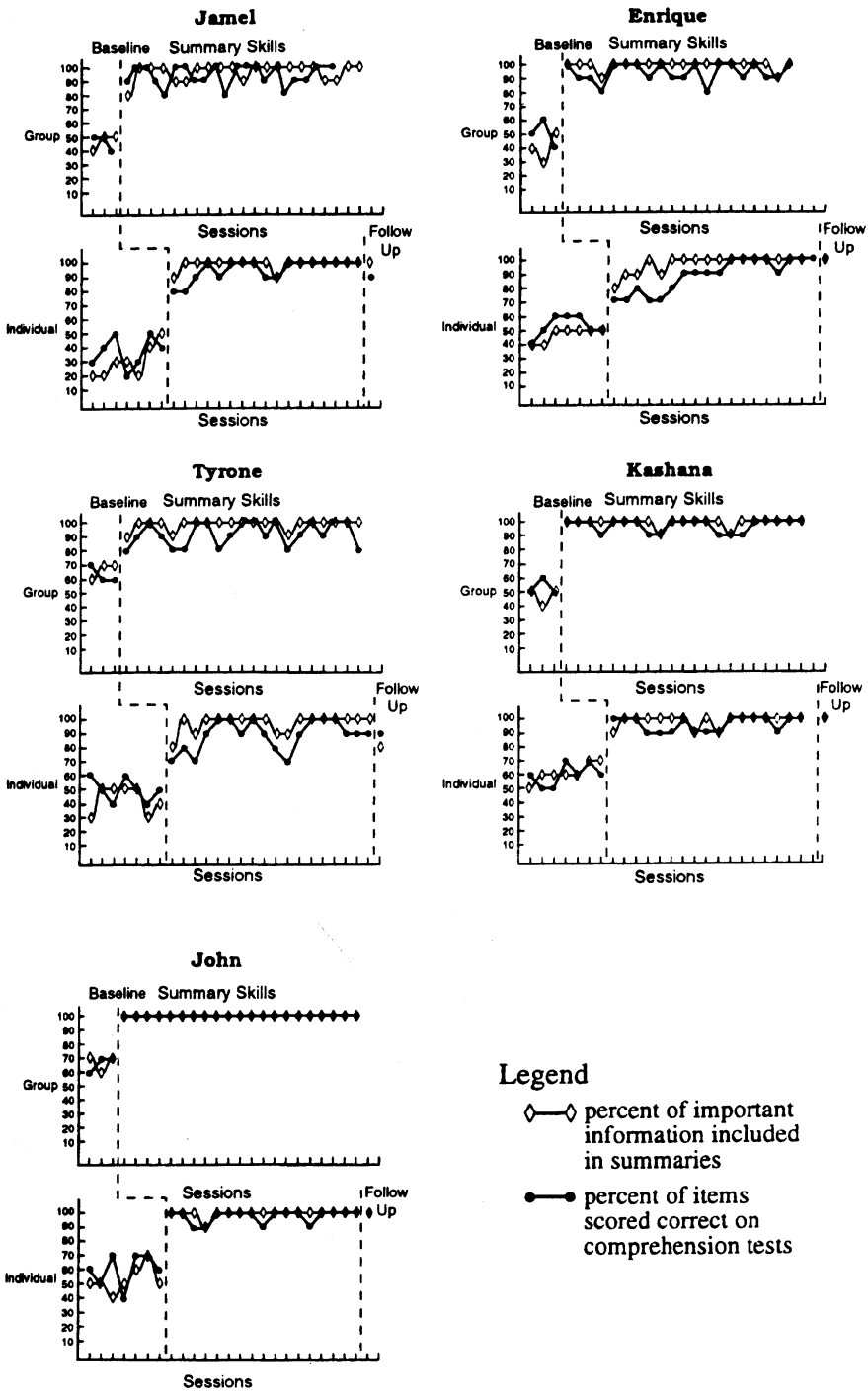

Figure 2. Percentage of items scored correct on comprehension tests and percentage of important information included in summaries.

Table 2
Mean Social Validity Ratings by Students and Teachers

Question	Mean[a]	*SD*
Students		
1. Understand science better?	4.61	.32
2. Write better papers?	4.42	.51
3. Would use to read about science?	4.63	.35
4. Would use to write about science?	4.36	.58
Teachers		
1. The procedure would improve the reading and writing of students with learning disabilities?	4.63	.41
2. The procedure would improve the reading and writing of all students?	4.26	.71
3. Students would use the procedure?	4.41	.64
4. Teachers would implement the procedure?	4.27	.61
5. The procedure would be easy to implement?	4.23	.75

Note. Higher ratings reflect stronger agreement with the statement (NO or 1 = strongly disagree to YES or 5 = strongly agree, or 3 = undecided).
[a]For all means, the 95% confidence limits failed to encompass the midpoint or neutral point of the scale.

instituted. There were also consistently higher levels of performance in the independent reading setting, which were maintained at the 4-week follow-up session.

Confidence in these results is increased by the fidelity of implementation data. These findings showed that the teacher fully completed the teaching functions in sequence in 100% of the group reading sessions. In addition, students completed an average of 85% (range = 75% to 100%) and 96% (range = 88% to 100%) of the steps included on the summary skills guide under the group and independent reading conditions, respectively.

Table 2 presents the mean responses and standard deviations by the students and teachers to the social validity questions. For all means, the 95% confidence limit failed to encompass the midpoint or the neutral point of the scale. Experimental students were individually asked four questions regarding the effectiveness and usefulness of the summary skills strategy. These students indicated that the strategy would help students to better understand and write about what they read in science. They also thought that students would use the strategy when they read about science.

Consistent with the positive views of students, teachers indicated that the summary skills strategy would improve the overall comprehensiveness of the summaries and reading comprehension of students (those with and without

learning disabilities). They also indicated that general education teachers would view the procedure positively and that the strategy would be easy to implement.

Discussion

Because students identified as having learning disabilities are often characterized by a lack of active task engagement and persistence (Torgesen, 1982) and by a lack of the skills necessary to execute and monitor the cognitive processes central to school success (Alley & Deshler, 1979; Baumann, 1984), learning strategy instruction appears to be especially beneficial for such students. Indeed, a prolific body of work on this type of instruction has shown that students identified as learning disabled and others experiencing difficulty in school can be taught to independently direct their affective state (Morris, Davis, & Hutchings, 1981), classroom deportment (Smith et al., 1992), and academic performance (Englert et al., 1991; Mastropieri et al., 1991).

These strategies have been found to be very useful in the area of reading (Clark et al., 1984; Wong et al., 1986) because many students identified as learning disabled have been found to be less able to identify main ideas (Wong, 1979), have more difficulty in summarizing text (Winograd, 1984), and have more difficulty monitoring their learning (Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989) than normally achieving students. Summary skills training is one learning strategy that has been found to improve the comprehension of structured expository text by students identified as learning disabled and by poor readers (Armbruster et al., 1987; Bean & Steenwyk, 1984; Brown & Day, 1983; Day, 1980; Garjria & Salvia, 1992; Hare & Borchardt, 1984; Palincsar & Brown, 1984; Rinehart et al., 1986; Taylor & Beach, 1984; Winograd, 1984). This work, however, has demonstrated only that these strategies are effective for improving students' comprehension of expository text that had been structured to meet the task demands of the summary skills strategies.

The present study was designed to extend this work by studying the effects of this type of strategy on students' comprehension of classroom science text that had not been structured to meet the task demands of the strategy. In general, the findings of the present study support previous work with summary skills strategies that has shown that such strategies improve students' comprehension (Hare & Borchardt, 1984; Garjria & Salvia, 1992; Palincsar & Brown, 1984). Furthermore, the findings suggest that summary skills strategies can be used to improve students' comprehension of a classroom science text that had not been specifically structured to meet the task demands of the strategy. This is important because the widespread use of summary skills strategies (or any other learning strategy) will occur only if they can be structured to meet the variable nature of most classroom texts and contexts.

The clear changes under both the group and the independent reading conditions associated with the introduction of the summary skills strategy in reading comprehension, coupled with increases in the completeness of the text summaries across the 5 students, clearly demonstrate the efficacy of the strategy. The results of the maintenance probe conducted in the independent reading condition at the 4-week follow-up indicated that the summary skills were maintained. Taken together, these findings suggest that the generative tasks included in the summary skills strategy (i.e., the identification of the main idea(s) and important information and the writing and revising of a summary) were complementary to one another. Because these results may have been confounded by limitations associated with the ceiling effects of the measures, additional research is needed to determine whether these generative tasks are indeed complementary.

Furthermore, the clear changes in the completeness of the summaries relative to baseline are consistent with research that suggests some students with learning disabilities have content-generation problems because they are not particularly successful in employing self-directed memory search strategies and have difficulty meeting the purpose, conventions, and features of the material under consideration (Englert & Palincsar, 1991; Raphael, Fear, & Anderson, 1988; Thomas, Englert, & Gregg, 1987). The summary skills strategy provided a framework to help students both recall the content and decide what information to include in their summaries. It is possible that the effects of the strategy were augmented by the relatively consistent organizational pattern of the science text. Further research is needed to determine whether summary skills strategies facilitate students' recall of important content information and their understanding of the conventions and features of other types of literature.

The failure of the treatment effects to generalize to the independent reading condition in the present study conflicts with previous work conducted with summary skills strategies that has demonstrated generalization of the strategies (Garjria & Salvia, 1992; Hare & Borchardt, 1984). Improvements in the completeness of the students' summaries and their comprehension of the science text in the independent condition occurred only after students were instructed to use their summary skills guide. This finding is interesting given that the 4-week follow-up maintenance probe showed that the summary skills had maintained. This suggests that failure of the treatment effects to generalize to the independent reading sessions may have resulted because the training procedures were not adequate to promote generalization of the summary skills in the time provided; that is, there were not enough training sessions to promote the generality of the skill. The failure of the summary skills strategy generalize to the independent reading condition also may have resulted because, in contrast to previous work, the task demands were variable across the conditions or the summary skills strategy itself lacked the requisite component(s) necessary to do so.

Overall, these data show that elementary-age students can reliably implement and utilize summary skills strategies and that students and teachers view them positively. Most importantly, these data support the growing body of theoretical and empirical work focusing on the importance of reading–writing connections (see Shannon & Tierney, 1990, for a review of this work). However, a number of questions about generalization and maintenance remain unanswered. Further research will be necessary to determine the features of the summary skills strategy that are necessary to produce generalization and maintenance of effects, the length of time students will continue to use the summarization skills, and the factors that affect students' use of the summarization skills.

Authors' Note

The data reported here were collected when the first and second authors were at the University of Illinois at Chicago.

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